

Alternative fuels at NASA Glenn Research Center Clear the Air for Workers and Cleveland

Linda Sekura 10-27-03

The NASA Glenn Research Center in Cleveland is reminiscent of a small town from the 1940s. Rows of small brick buildings and crabapple-lined roads are interspersed with odd metal structures for propulsion research. In this small confined town, exhaust constantly emits from delivery trucks and personnel shuttles, from forklifts in enclosed warehouses, and even from propulsion testing facilities.

Several years ago, these multiple exhausts were mostly from the burning of fossil fuels such as unleaded gasoline and diesel. Aside from global warming and acid rain caused by the burning of fossil fuels, there is the simple issue of odor. Global warming will affect us all in the long run, but a bad odor will stop workers in their tracks immediately. An odor issue propelled an alternative fuel project to quick completion at GRC.

JP-8 (a kerosene-based fuel in military and airline use) had replaced the costly hydrogen fuel in our Aero-Acoustical Propulsion Lab (AAPL). When the AAPL staff would light JP-8 to run hot tests, complaints would flood in from surrounding buildings, depending on the wind direction. According to the Facility Engineer at AAPL, "It was a noxious barbecue-type smell," like lighter fluid. "It would give people headaches." AAPL was faced with the prospect of shutting down or finding another solution. Propane was heavier than air, creating a fire hazard if fumes escaped, so lighter-than-air compressed natural gas (CNG) was selected. At its next normal maintenance interval, the AAPL combustor was changed out and CNG implemented. In over nine months of operation, AAPL has not received a single complaint. "There is absolutely no odor."

CNG is also a fossil fuel, but gasoline has a more complicated molecular structure, so CNG doesn't have the same huge emissions of carbon monoxide (90-97% less) and nitrogen oxides (35-60% less). But, two renewable alternative fuels (both biobased) are being used or studied at GRC: biodiesel from soybeans and ethanol ("E85"), a corn product.

Biodiesel was implemented when there was trouble with a barrel truck whose batteries were not charging properly. Since it was difficult to restart, the truck would be kept running when parked and making deliveries, causing some building occupants to complain. A 9-month pilot program at GRC studied one vehicle using various diesel to biodiesel percentages. One of the biggest concerns was fuel-line freezeup in Northeast Ohio's winter weather, so a widespread Midwest solution – 20% biodiesel to 80% low-sulfur diesel (called "B20") - was chosen. By the end of January, GRC had experienced the winter's coldest weather conditions with no cold weather related problems. During warmer weather, a test vehicle made a run to Glenn's Plum Brook Station, an hour away, on 100% biodiesel with no problem, except making the driver hungry. He said, "It smelled like French fries."

The drivers say that vehicles run just as well on biodiesel, and some feel they run better. The biodiesel acts as a solvent, cleaning out the lines. The fuel filter clogs the first time biodiesel is run through, but once the contaminants are cleared out by the biodiesel, there are no more filter problems. Biodiesel also reduces emissions, and is biodegradable and nontoxic.

The other biobased fuel in use at GRC is called E85. E85 is 85% ethanol blended with 15% gasoline. Ethanol is 100% pure grain alcohol produced by fermenting plant sugars, but most ethanol comes from corn, since it is most easily converted to sugar. Using E85 instead of gasoline reduces emissions, especially carbon monoxide by 40% and sulfates by 80%. In the 1880s, Henry Ford designed a car that ran only on ethanol, and the Model T was designed to run on either ethanol or gasoline. 120 years later, there are over 160 fueling stations offering E85 in 24 states.

GRC recently converted a 10,000 gallon underground storage tank to E85, and installed an E85 dispenser. The Center now E85 in twelve E85-compatible vehicles, and will replace older vehicles at future intervals.

Over half of the GRC owned and leased fleet of 145 vehicles utilizes some form of alternative fuel. All 36 diesel vehicles, stationary diesel storage tanks, and all equipment using the tanks, like generators, use B20 biodiesel. 38 vehicles use CNG: shuttle busses, cargo vans, passenger vans, pick-up trucks, and passenger cars. One forklift will be used for a CNG emissions study, with a goal of converting several forklifts from propane to CNG to improve indoor emissions for workers.

If you would like to learn more about alternative fuel usage at NASA/GRC, please contact their P2 Team at 216-433-8441.